Q1

There are two section of **bounded\_knapsack method**:

**First section :**

Take each of the original items, spilt it into new items, with new quantity and respective weight. Then store then into an items array.

Example: if the item quantity is 10, it will be spilted to 4 new items, as quantity: 1(2^0), 2(2^1), 4(2^2), 2(remaining quantity),

the weight will be the new\_quantity \* weight.

Since there are N items(N = the number of item of the original input) , and for each item the complexity will be log(max\_quantity)

Therefore, overall Time complexity of this section will be **O(N \* log(max\_quantity))** :

where 'max\_quantity' is the max quantity of any item;

**Second section:**

After splite all the original items, a new items array will be created., with new items\_len(the length of items in the new items array).

Then, do a bottom up approach of 0-1 kmapsack problem, which the Time complexity will be **O(items\_len \* limit):**

where 'limit' is the knapsack's capacity;

'items\_len' is the length of the new items array created in first section;

**Overall Time Complexity:**

Since items\_len is created by first section, with time complexity: O(N \* log(max\_quantity))  
Therefore, overall time complexity of the bounded\_knapsack method will be **O(N \* log(max\_quantity) \* limit):**

Where 'N' is the number of item of the original input;

'max\_quantity' is the max quantity of any item;

'limit' is the knapsack's capacity;

**Q2:**

**longest\_bitonic\_subsequence method :**

As there are two nested for loops, with each based on the length of the input array. So the time complexity will be **O(n^2):**

where 'n' is the length of the input array;

**lcs method :**

Using memoization approach, to find the lengthe of the longest common subsequence, the time complexity is **O( m \* n)**:

where 'm' is the length of the array 1;

'n' is the length of the array 2;

**getAllSubsequences :**

There are three nested for loops to get all the possible longest common subsequences based on the max length of the LCS, the time complexity of this method will be upper bounded by it. Therefore, the time complexity of this method will be **O(u \* m \* n)**:  
where 'u' is the length of the unique elements, when two input arrays are combined;  
'm' is the length of array 1;

'n' is the length of array 2;

**Overall time complexity:**

The overall time complexity is upper bounded by the getAllSubsequences method. Therefore, the overall time complexity will be **O(u \* m \* n):**

where 'u' is the length of the unique elements, when two input arrays are combined;  
'm' is the length of array 1;

'n' is the length of array 2;

**Notes: Q3, eLearn does not accept .txt file**